

# HOUSEKEEPING PAD DESIGN

The following section identifies those procedures that should be followed to ensure that Housekeeping pads used in structures located in seismically prone areas, will remain intact and in place when exposed to a seismic event. However, no claims are made in this document as to the ability of the structural slab underneath the housekeeping pad to withstand the seismic loads being transmitted into it. The guide is offered solely as a recommendation to other engineers and contractors as a tool that can aid in selecting an appropriate housekeeping pad design. As with other elements of the structure, the Engineer of record has the final say as to the suitability of these parameters to the project at hand.

## General

Housekeeping pads have been used for years as a device to allow isolated equipment to be more easily kept clear of debris and to enhance both the time required for maintenance and the appearance of mechanical rooms. As the demand for appropriate seismic restraint has become more stringent, housekeeping pads have evolved to serve as a structural interface that distributes localized point loads generated by attached equipment to the more globally designed mechanical room floor structure.

It is not untypical for the anchorage embedment requirements for particular pieces of equipment to exceed the maximum permitted embedment depth in a mechanical room floor slab. In these cases, the housekeeping slab thickness can be selected to meet the equipment anchor needs and then through an array of anchors that connect the housekeeping pad to the structure, this load can be distributed to a larger quantity of smaller anchors that are compatible with the floor slab.

Critical to this interface is the housekeeping pad thickness, the grade of concrete used, the adequacy of the connection between the housekeeping pad and the floor slab and appropriate reinforcement in the housekeeping pad to keep it from splitting apart. It is equally critical to ensure that the equipment anchors can not rupture the housekeeping pad and pull free. This is accomplished by providing an adequate edge distance between the anchor and the perimeter of the housekeeping pad itself as well as proper spacing between the anchors.

## Housekeeping Pad Thickness and Perimeter Dimensions

Before specifying a housekeeping pad, it is critical to determine the size and locations of the anchors that are being used to attach the equipment. Kinetics Noise Control or some other reputable source should perform an analysis, with the appropriate mounting hardware being selected and mounting locations determined. Once anchors are selected, the embedment depth for the anchors can be identified. This is generally 8 times the anchor diameter, but in a few cases, could be more. Refer to the Anchor section (P10) in

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Toll Free (USA only): 800-959-1229  
International: 614-889-0480  
Fax: 614-889-0540  
World Wide Web: [www.kineticsnoise.com](http://www.kineticsnoise.com)  
Email: [sales@kineticsnoise.com](mailto:sales@kineticsnoise.com)

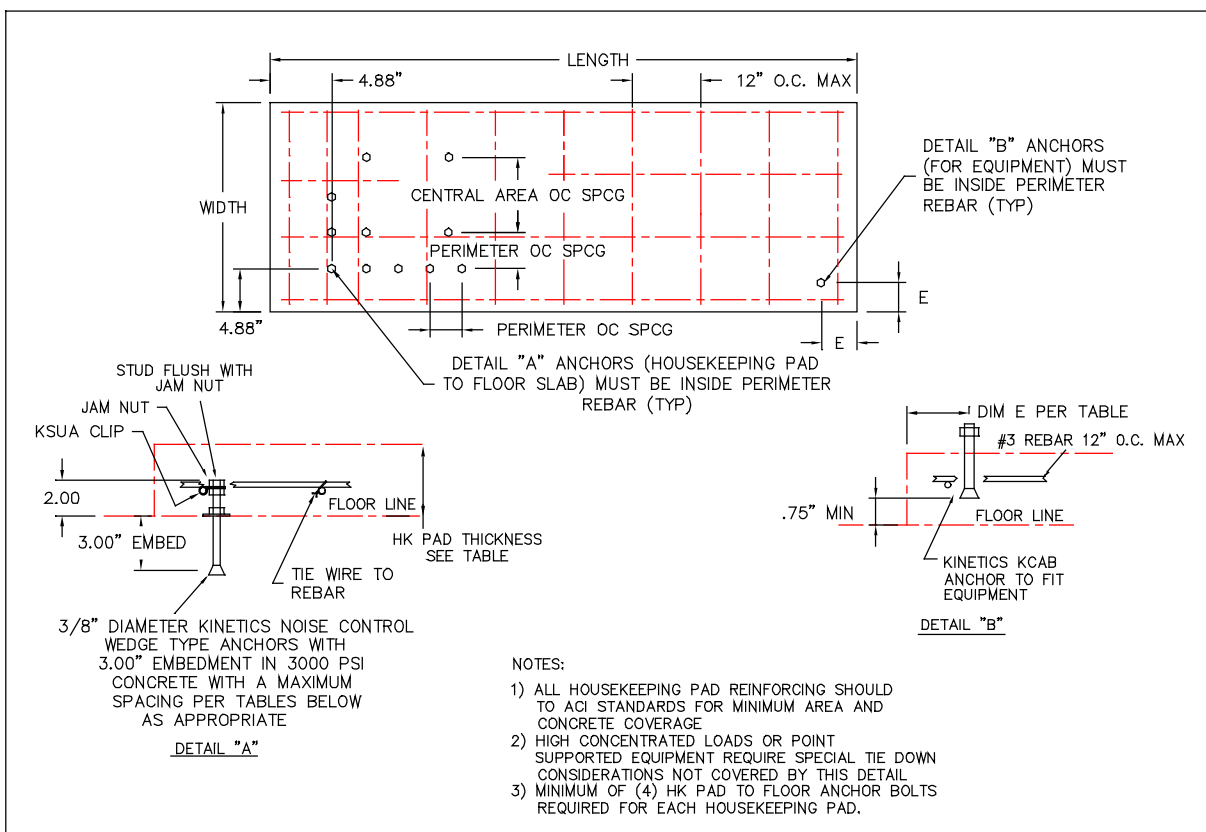
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this manual or the calculation performed to verify this dimension. As it is necessary that anchors be embedded in a single contiguous pour, it will be necessary for the anchor to achieve its full embedment in either the structural floor slab or the housekeeping pad. The only exception to this is when the housekeeping pad has been poured along with the structural slab. In addition, for most applications using KCAB anchors at least 3/4" of cover under the anchor is required. Thus, if 6" of embedment is required for the anchor, a minimum contiguous concrete thickness of 6-3/4" is needed to accommodate this. (Note, if the anchor is being directly embedded into a slab on grade, the minimum cover over the end of the anchor increases to 1-1/2". See also the chart in Section P10.2.1 of this manual for more information on this.)

Referring also to the Anchor section (P10) of this manual, the minimum allowed edge distance is also identified by anchor size. This is the minimum allowed distance from the anchor centerline to the nearest edge of a housekeeping pad. Using this information along with the previously identified anchor attachment pattern, a minimum housekeeping pad profile can be determined.



Housekeeping Pad General Layout

### Tabulated Design Data Assumptions

In using the tabulated data listed in this section, the following assumptions have been

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 International: 614-889-0480  
 Fax: 614-889-0540  
 World Wide Web: www.kineticsnoise.com  
 Email: sales@kineticsnoise.com

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made.

- 1) The concrete used in the housekeeping pad is 3000 psi min, standard weight.
- 2) Anchorage ratings have been derated to meet current US standards for all applications except those requiring certification from OSHPD.
- 3) The structural concrete used is 3000 psi min and standard weight.
- 4) The thickness and profile are in accordance with the sizing information listed above.
- 5) The housekeeping pad is attached to the structural slab using 3/8" diameter x 5" long KCAB anchor bolts that are embedded 3" into the structural slab, protrude 2" into the housekeeping pad and are physically connected to internal #3 rebar using KSUA clips. (It is only possible to use larger anchors if the structural slab is greater than 4" in thickness.)

### Use of Tables

- 1) Divide the total Operating Equipment weight by the overall length of the housekeeping pad to get a weight per foot value.
- 2) Verify that the vertical dimension from the top of the housekeeping pad to the equipment CG is less than the 2/3 of the width of the housekeeping pad. (If this is not the case, either the pad will have to be made wider or a custom analysis will have to be performed by Kinetics Noise Control or other qualified source.)
- 3) Determine the Seismic acceleration for the equipment type and location in the structure under review. All acceleration values are listed in the attached tables include all factors and are expressed in stress based (ASD) units regardless of the code used. If using the 97 UBC, the IBC or TI-809-04, the values that result from the code driven factors are strength based (LRFD) and should be reduced by a factor of 1.4 prior to using these tables. (Note: this has already been done if using Kinetics Noise Control provided certification documents.) If factors are provided in the project specification that exceed the code values, the higher values should be used as a basis for design.
- 4) Select the table with the appropriate design acceleration factor.
- 5) Reading across the top of the table, find the equipment weight per foot and the housekeeping pad thickness previously determined
- 6) Read down the column until you find the housekeeping width that will allow the equipment mounting anchors to be installed and maintain adequate edge distances.
- 7) The value listed in upper portion of the table is the maximum center to center distance for anchors placed around the perimeter of the housekeeping pad.
- 8) The value listed in lower portion of the table is the maximum spacing between anchors in the central area of the housekeeping pad.
- 9) A minimum of 4 anchors is required per pad.
- 10) Refer to the drawing below for reinforcement and housekeeping pad details.
- 11) All pad reinforcement should conform to ACI standards for minimum area and concrete coverage.

### Special Applications

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Email: [sales@kineticsnoise.com](mailto:sales@kineticsnoise.com)

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For Design conditions outside of those allowed by the above Tables, consult Kinetics Noise Control.

### Sample Pad Design

Conditions:

10,000 lb chiller

Seismic Acceleration .47 g (in ASD units at equipment location)

Anchorage spacing (from equipment) 112" x 48"

Anchor size (from equipment analysis) .75"

Pad Thickness

Embedment required for .75" anchor is 6" (from anchor table in P10.2.1 of this manual). Minimum cover is .75" so minimum thickness is 6.75". Use 8" pad.

Pad Length

Minimum edge distance for .75" anchor is 9.75" (from anchor table in P10.2.1 of this manual). Minimum pad length is 9.75" (edge distance) + 112" (spacing) + 9.75" (edge distance) or 131.5" (call it 11 ft).

Pad Width

Using above minimum edge distance the minimum width is 9.75" (edge distance) + 48" (spacing) + 9.75" (edge distance) or 67.5"

Weight per foot of length is 10,000/11 or 909 lb/ft.

Referring to the .5g table and the 1000 lb/ft column with an 8" thick pad, the maximum perimeter anchor spacing for a 4-6 ft wide pad is 36". The maximum central area anchor spacing is 48".

### Design Tables

| Seismic Acceleration (at Equipment) |                | 0.25 g                      |     | ASD Based Values |     |     |     |     |     |     |      |      |      | With the 97 UBC, IBC, or TI-809-04 code reduce the LRFD "g" value by 1.4 |      |      |      |      |    |
|-------------------------------------|----------------|-----------------------------|-----|------------------|-----|-----|-----|-----|-----|-----|------|------|------|--|------|------|------|------|----|
|                                     |                | Maximum Anchor Spacing (in) |     |                  |     |     |     |     |     |     |      |      |      |  |      |      |      |      |    |
| Equip Wt/Ft (lb)                    |                | 250                         | 250 | 250              | 500 | 500 | 500 | 750 | 750 | 750 | 1000 | 1000 | 1000 | 1000   | 1500 | 1500 | 1500 | 1500 |    |
| HouseKeeping Pad Thk (in)           |                | 4                           | 6   | 8                | 4   | 6   | 8   | 4   | 6   | 8   | 10   | 4    | 6    | 8  | 10   | 4    | 6    | 8    | 10 |
| Perimeter Spacing (in)              | Pad Width (ft) |                             |     |                  |     |     |     |     |     |     |      |      |      |  |      |      |      |      |    |
|                                     | 1 - 2          | 36                          | 36  | 36               | 36  | 36  | 36  | 36  | 36  | 36  | 36   | 36   | 36   | 36   | 36   | 36   | 36   | 36   | 36 |
|                                     | 2 - 4          | 36                          | 36  | 36               | 36  | 36  | 36  | 36  | 36  | 36  | 36   | 36   | 36   | 36   | 36   | 36   | 36   | 36   | 36 |
|                                     | 4 - 6          | 36                          | 36  | 36               | 36  | 36  | 36  | 36  | 36  | 36  | 36   | 36   | 36   | 36   | 36   | 36   | 36   | 36   | 36 |
|                                     | 6 - 8          | 36                          | 36  | 36               | 36  | 36  | 36  | 36  | 36  | 36  | 36   | 36   | 36   | 36   | 36   | 36   | 36   | 36   | 36 |
|                                     | 8 - 10         | 36                          | 36  | 36               | 36  | 36  | 36  | 36  | 36  | 36  | 36   | 36   | 36   | 36   | 36   | 36   | 36   | 36   | 36 |
|                                     | 10 - 12        | 36                          | 36  | 36               | 36  | 36  | 36  | 36  | 36  | 36  | 36   | 36   | 36   | 36   | 36   | 36   | 36   | 36   | 36 |
| 12 - 15                             | 36             | 36                          | 36  | 36               | 36  | 36  | 36  | 36  | 36  | 36  | 36   | 36   | 36   | 36   | 36   | 36   | 36   | 36   |    |
| 15 - 20                             | 36             | 36                          | 36  | 36               | 36  | 36  | 36  | 36  | 36  | 36  | 36   | 36   | 36   | 36   | 36   | 36   | 36   | 36   |    |
| Central Area (OC Spg) (in)          | 1 - 2          | 48                          | 48  | 48               | 48  | 48  | 48  | 48  | 48  | 48  | 48   | 47   | 46   | 45   | 45   | 34   | 34   | 33   | 33 |
|                                     | 2 - 4          | 48                          | 48  | 48               | 48  | 48  | 48  | 48  | 48  | 48  | 48   | 48   | 48   | 48   | 48   | 48   | 48   | 48   | 48 |
|                                     | 4 - 6          | 48                          | 48  | 48               | 48  | 48  | 48  | 48  | 48  | 48  | 48   | 48   | 48   | 48   | 48   | 48   | 48   | 48   | 48 |
|                                     | 6 - 8          | 48                          | 48  | 48               | 48  | 48  | 48  | 48  | 48  | 48  | 48   | 48   | 48   | 48   | 48   | 48   | 48   | 48   | 48 |
|                                     | 8 - 10         | 48                          | 48  | 48               | 48  | 48  | 48  | 48  | 48  | 48  | 48   | 48   | 48   | 48   | 48   | 48   | 48   | 48   | 48 |
|                                     | 10 - 12        | 48                          | 48  | 48               | 48  | 48  | 48  | 48  | 48  | 48  | 48   | 48   | 48   | 48   | 48   | 48   | 48   | 48   | 48 |
|                                     | 12 - 15        | 48                          | 48  | 48               | 48  | 48  | 48  | 48  | 48  | 48  | 48   | 48   | 48   | 48   | 48   | 48   | 48   | 48   | 48 |
| 15 - 20                             | 48             | 48                          | 48  | 48               | 48  | 48  | 48  | 48  | 48  | 48  | 48   | 48   | 48   | 48   | 48   | 48   | 48   | 48   |    |

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 Fax: 614-889-0540  
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